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Semantic Compositionality and Construal Operations: The Case of the Healthy-Noun Construction

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1. Introduction

How do people understand phrases such as *a healthy person*, *healthy exercise*, and *a healthy look*? If one claims that the meaning of the whole phrase can be gained by a simple sum of the semantics of the component parts (i.e., the modifier *healthy* and the modified nouns *person*, *exercise*, and *look*), the problem I would like to discuss in this paper might appear quite simple. However, I will argue that such a "componential" view of semantics is not empirically plausible, since comprehension of these phrases involves various construal operations that should be accounted for with a cognitive linguistic approach as the present paper seeks.

In this paper, I will mainly discuss the semantics of the English Adjective-Noun (EAN) construction (e.g., *red pencils*).¹ Issues of semantic compositionality of the EAN construction range over a variety of phenomena, depending on the type of words that participate in the combination. Thus, in this paper, in order to keep the paper within manageable proportions, we will mainly limit ourselves to the arguments on the "Healthy-Noun" (Healthy-N) construction, which is in a taxonomic relation with the EAN construction to which it belongs, and attempt to reveal various interesting aspects of semantic compositionality that have not been exposed in detail in the literature.²

The main objectives of this paper can be divided into two: 1) to show the validity of the frame-semantic approach to the semantics of the EAN construction, and 2) to propose a constructional approach to the theory of semantic compositionality.³ As opposed to traditionally dominant symbolic approaches by logical and generative linguists, this paper argues that semantic compositionality involves construal operations to resolve discrepancy between a profile and a relevant active zone based on the frame-semantic knowledge of words and the functional restriction imposed by the construction.

In the next section, I will introduce two different approaches, and claim that the traditionally dominant symbolic approach is not plausible. Detailed analyses of the Healthy-N construction will then be provided in sections 3, 4, and 5.

¹ Following the custom in Croft's (2001) *Radical Construction Grammar*, I will call this construction the English Adjective-Noun construction. See Croft (2001: 49-51), for discussions as to the problem of labeling of a construction.

² See Croft (2001: 25-29) and Cruse and Croft (in press: chapter 12) for how the grammatical knowledge of a speaker is represented in construction grammar.

³ Frame semantics is a semantic theory proposed by Fillmore (1982a), where he argued that interpretation of linguistic expressions depends on the frames (knowledge of the world). The frame-semantic knowledge is "shared", or "believed to be shared, by at least some segment of a speech community" (Taylor 1995: 89). In cognitive linguistics, similar terms to "frames" include "domains" (Langacker 1987: chapter 4) and "idealized cognitive models" (Lakoff 1987: chapter 4). Each term is not exactly identical, but in this paper, we use frames as the cover term to refer to the knowledge system about the world.

2. Previous studies of semantic compositionality of the EAN construction

One can divide approaches to issues on semantic compositionality roughly into two, based on the view of meaning taken in each theory. One is what Lakoff (1987) calls the "objectivist" approach whose view of meaning is based on the classical symbolic view. In such a classical view, it is argued that "all rational thought involves the manipulation of abstract symbols which are given meaning only via conventional correspondences with things in the external world" (Lakoff 1987: xii). The other approach is the "conceptualist" approach that questions the validity of the classical symbolic approach and instead argues that linguistic phenomena should be studied in terms of general cognitive processes.⁴ This section introduces these two different approaches and discusses which one is more preferable.

2.1. The objectivist approach

There are three typical analyses in the objectivist approach: 1) an analysis based on the notion "selection(nal) restriction", 2) one based on "logical rules", and 3) one based on "syntactic rules".

In the objectivist approach, it is argued that 1) "[c]ategories are defined in terms of a conjunction of necessary and sufficient features", 2) "[f]eatures are binary", 3) "[c]ategories have clear boundaries", and 4) "[a]ll members of a category have equal status" (Taylor 1995: 23-4).⁵ For example, a typical objectivist analysis can be found in the early stage of generative grammar that used the notion of selection(al) restriction (e.g., Katz and Fodor 1963; Chomsky 1965), where it is argued that such instances as *infant bachelor* are not acceptable, since the binary feature [-ADULT] of *infant* does not conform to the feature [+ADULT] of *bachelor* (Taylor 1995: 31).

The classical semantic analysis, however, suffers from several empirical facts. Fillmore, for example, argues that the classical feature-based model cannot account for nonprototypical examples of *bachelor* such as "male participants in long-term unmarried couplings", "a boy abandoned in the jungle and grown to maturity away from contact with human society", and "John Paul II" (Fillmore 1982b: 34).

Fillmore instead argues that the noun *bachelor* can be defined as an unmarried man "only in the context of a human society in which certain expectations about marriage and marriageable age obtain" (Fillmore 1982b: 34). Understanding a word involves such an idealization, and this is what Lakoff (1987) calls "idealized cognitive models" (ICMs). ICMs (or frames) of *bachelor* are the source of the recognition of interpreters as to whether an example of *bachelor* sounds acceptable or not. Interpretation of an expression depends on if one's ICM of *bachelor* fits the world, and hence cannot be captured by the feature-based model that simply uses binary features without any references to the world.⁶

The invalidity of the classical semantic approach is also posed by psychological studies (e.g., Labov 1973, Rosch 1978). For example, Rosch and her collaborators revealed through a series of psychological experiments, that 1) concepts have a prototype, 2) there are no necessary and sufficient attributes to determine a category membership, and 3) a category consists of members based on their similarity with the prototype in the category.⁷

Let us now look at the objectivist approach taken by logical semanticists. It is the principle

⁴ See also Langacker (1991a: chapter 12) for discussions on the difference between the objectivist approach and the conceptualist approach.

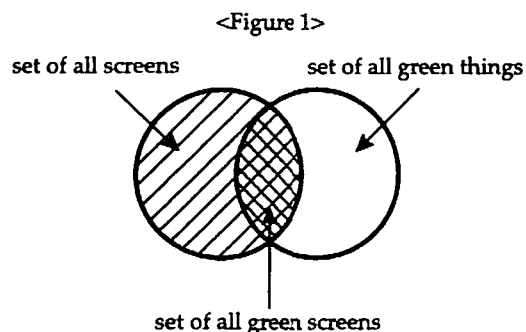
⁵ For extensive discussions of the classical symbolic approach and the alternative view, see Lakoff and Johnson (1980), Lakoff (1987), Taylor (1995); for relevant discussions particularly from the perspectives of AI, philosophy, and cognitive science, see Dreyfus (1979, 1982, 1992) and Dreyfus and Dreyfus (1988).

⁶ See Lakoff (1987: chapter 4), for more detailed discussions.

⁷ See, for example, Rosch and Mervis (1975) and Rosch (1978).

of compositionality, which is defined as "the meaning of a sentence is determined by the meaning of its words *and* by the syntactic structure in which they are combined" (Hayasaka and Toda 1998: 126), that has been the main drive of objectivists, especially to formal logicians, to the study of the semantics of the EAN construction.

Hayasaka and Toda, for example, based on the traditionally dominant "intersection" analysis, note that: "Most linguists would analyze the phrase *green screen* in terms of sets. Imagine first the set of all things that are screens; then imagine a second set, made up of all the things that are green in color. Anything that belongs to both sets—that is, the intersection of these two sets—is a green screen" (Hayasaka and Toda 1998: 127). Figure 1 depicts this situation.



—Hayasaka and Toda (1998: 127)

Formal logicians have taken the intersection analysis so influentially as the basic method. For example, Cann (1993: 171) also follows such an analysis and provides (1) as a translation of the EAN phrase *happy student*.

$$(1) \text{ happy student} \Rightarrow \lambda y [\text{happy}'(y) \ \& \ \text{student}'(y)].$$

In order to guarantee the proposition that every student is happy and every happy student is a student, Cann provides (2).

$$(2) \text{ happy} \Rightarrow \lambda P_1 [\lambda y \{\text{happy}'(y) \ \& \ P_1(y)\}].$$

Cann notes that the expression in (2) denotes "a function that maps the set of entities denoted by the common noun to the set of entities which appear in the intersection of this set with the set of entities denoted by the predicative adjective *happy*" (Cann 1993: 171).

Adjectives such as *happy* that are expected to be captured by the expression in (2) are called "intersective" adjectives. The rule (3) is a general rule that takes the predicative adjective translation and outputs its attributive counterpart (Cann 1993: 171).

$$(3) \text{ If } a \text{ is a predicative adjective with translation } a', \text{ then its attributive counterpart has a translation } \lambda P [\lambda x [a'(x) \ \& \ P(x)]].$$

At first glance, the intersection analysis introduced above might look reasonable. However, this analysis is too simplistic to be a plausible model that captures the complexities of construal operations of conceptual combination of the component words of the EAN construction. Roughly, there are at least two practical problems and one fundamental theoretical problem that I argue the objectivist approach to semantic compositionality is not plausible.

A first problem is that although one needs to capture empirical facts of the semantics of the EAN construction, this does not appear possible in the objectivist approach. For example, it appears that the objectivist approach does not even provide an adequate account for their

favorite instances consisting of a combination of an intersective adjective and a noun, such as *green screens* introduced above, since it does not capture the ambiguity of this phrase.

Green screens is semantically ambiguous as to whether the objects in question refer to screens that have a green ribbon on them in order for one to differentiate from other red-colored screens, or they refer to those originally painted in green paint but now look yellowish as the strong sunshine has caused them to fade, and so forth. As mentioned above, in the objectivist analysis by logical semanticists, the meaning of *green screens* is claimed to be captured by the intersection analysis. However, the semantics of this expression is indeed not as simple as formal logicians expect. In reality, it involves much more complex conceptualization, as cognitive linguists such as Langacker (1991b) and Sweetser (1999) suggest. Such construal operations do not seem to be captured in the objectivist approach in an empirically plausible way, since this approach does not take into consideration underlying cognitive processes to account for flexible construal operations as the conceptualist approach does.

A second problem with the objectivist approach concerns the classification of adjectives. Cann classifies adjectives into two groups: intersective adjectives and intensional adjectives. According to him, intersective adjectives include such adjectives as *happy*. On the other hand, according to him, intensional adjectives include adjectives such as *fake* as in *a fake gun*. Cann notes that the rule (3) cannot capture such examples consisting of intensional adjectives as *a fake gun* (since it is not a gun) and *an alleged murder* (since it does not necessarily refer to a murderer). He simply writes: "The interpretation of all these adjectives goes beyond the extensional semantics that has so far been developed and requires a definition of intensionality" (Cann 1993: 172).

I argue that such a classification of adjectives is a type of methodological opportunism.⁸ It simply shows what kind of adjectives can (and cannot) be described in the logical analysis, and does not offer us any further perspectives.

Essentially, this classification is indeed not plausible, since it misses a semantic difference of the same adjective with a different head noun. For example, *happy*, an intersective adjective by Cann's classification, does not seem to be classified as such in examples such as *a happy suggestion*, where it is not the suggestion itself that is happy, and the proposition that every suggestion is happy and every happy suggestion is a suggestion cannot be guaranteed, unlike *a happy student*.

It is possible to call *happy* in *a happy suggestion* an intensional adjective and *happy* in *a happy student* an intersective adjective. Yet, without providing any rigorous criterion or principles for such classification, the logical analysis as presented by Cann remains ad hoc. A rigorous semantic theory must provide some principled accounts for the semantics of adjectives. In fact, the second problem of the logical approach concerns the functional differences between the EAN construction and the English Predicative Adjective (EPA) construction (e.g., *These pencils are red.*), whose schema is [Sbj be Adj]. In the logical analysis introduced above, such a functional difference between the two constructions is ignored.

The same problem of neglect of a functional difference between the two constructions can be found in the generative approach. In the early transformational grammar, important theoretical constructs included such notions as "surface/deep structures" and "transformations". For example, Lakoff introduced one of the typical treatments proposed in the 70s to account for the derivation of the EAN construction as follows: "There are two rules in English which are necessary to derive the common adjectival construction that appears in *the tall man* from

⁸ See Croft (2001) for critiques of methodological opportunism in linguistic investigation.

relative clauses like *the man who is tall*. The first rule, call it WH-DEL, deletes the sequence WH + PRONOUN + BE when preceded by a noun and followed by either an adjective or a verb (adjective/verb). WH-DEL will convert *the man who is tall* into *the man tall*, Following WH-DEL, there is an obligatory rule which converts *the man tall* into *the tall man*. Call this ADJ-SHIFT" (Lakoff 1970: 122).

Such a transformational analysis also suffers from various empirical problems. As Bolinger (1967) points out, there are many instances that do not conform to such rules. For example, consider the following examples (cited from Bolinger 1967: 2-3).

- (4) a. the main reason; * The reason is main.
b. a total stranger; * The stranger is total.
- (5) a. an angry storm; * The storm is angry.
b. a medical man; * The man is medical.
- (6) a. The man is asleep; * an asleep man
b. The girl is sorry; * a sorry girl

In (4), it is shown that some adjectives never occur in the EPA construction, and thus do not conform to the transformational rule introduced above. Likewise, the examples in (5) show that there are some adjectives that allow particular uses in the EAN construction but do not occur in the EPA construction: they lack a predicative counterpart. The examples in (6) show the opposite situation. That is, there are some adjectives that occur in the EPA construction, but not in the EAN construction (at least not in the same sense). These examples show the invalidity of the transformational analysis, since they manifest the fact that many if not all instances do not have a predicative/attributive counterpart. Instead, these examples suggest different constructional functions between the EAN and EPA constructions.

Bolinger argues that the functional difference between the two constructions is ascribed to the difference between "characteristic" and "occasion". For example, regarding the examples in (7) (cited from Bolinger 1967: 3-4), he notes that while (7a) is ambiguous as to whether it tells the temporary states of rivers (the only river that happens to be navigable at the moment) or the classes of rivers, (7b) unambiguously refers to occasion, and (7c) unambiguously refers to the characteristic (Bolinger 1967: 3-4).

- (7) a. The only river that is *navigable* is to the north.
b. the only river *navigable*
c. the only *navigable* river

In the generative analysis (as well as the logical analysis), such a functional difference between the EAN and EPA constructions is ignored. Therefore, the generative approach cannot capture instances that do not conform to the rules they propose. As opposed to the objectivist approach, I argue that one needs to study the functional difference between the two constructions in order to achieve fine-grained analyses of semantic compositionality of the EAN construction. The constructional properties play crucial roles in acceptability and interpretability of expressions. In this paper, section 5 discusses the constructional properties of the two constructions.

A third problem with the objectivist approach is a fundamental problem that causes the two practical problems discussed above. This problem concerns the validity of the principle of compositionality itself. The theoretical assumption of the principle of compositionality from which the objectivist approach such as the intersection analysis starts is as follows:

If there were no direct relation between lexical and sentential meaning, of course, the

meaning of each sentence in a language would have to be listed. Since the number of sentences that make up a language is infinite, this would mean that no human being would be able to determine the meanings of all the sentences of any language owing to the finite resources of the brain. This is absurd, of course, and just as sentences are defined recursively by syntactic rules, taking words (or morphemes) as their basis, so their meanings should also be defined recursively from the meanings ascribed to the lexemes they contain (Cann 1993: 3).

That there should be a certain relation between lexical and sentential meaning is logically true, since otherwise, as Cann writes, one would have to list all the meanings of each sentence in the brain, and this is empirically impossible. I suggest, however, that formal logicians such as Cann make a fatal mistake here in ascribing the relation between lexical and sentential properties to symbol-manipulation rules. This is the crucial fundamental error made by formal logicians and generative grammarians, whose view of semantics has been based on the classical symbolic view.

As mentioned, Cann correctly notes that the formal semantics model needs more sophistication as to the treatment of different adjective types. He, however, still seems to have a firm belief in the explanatory power of such a formal model. Cann writes: "The analysis of intersective adjectives given here is just a beginning, but it gives a basis from which to start" (Cann 1993: 172). This demonstrates that Cann does not question the fundamental limitations of the objectivist approach, on which his model has been (and will be) built. The present paper questions the theoretical validity of the objectivist approach. It appears that such theoretical constructs as rules and arbitrary classification of adjectives result from the firm belief towards the objectivist approach. In this paper, following the above discussions about the problems the classical approach suffers from, we will not follow the objectivist approach.

2.2. The conceptualist approach

As opposed to the objectivist approach introduced in the preceding section, cognitive linguists (e.g., Langacker 1987, 1991a, 1991b; Sweetser 1999) argue that the objectivist approach to semantic compositionality is not plausible. They argue that conceptual combination of the component words of the EAN construction involves various construal operations, which cannot be captured with the symbolic view taken in the classical approach.

In cognitive linguistics, one takes what Langacker (1991a: 515) calls the "conceptualist" view of meaning as a central theorem of semantics, and the principle of compositionality is given a new perspective. It is argued that the meaning of the whole expression is more than the simple sum of meaning of the component parts. For example, in cognitive grammar, Langacker says: "In general, only *partial* compositionality can be assumed (as opposed to the *full* compositionality implied by the metaphorical view of component structures as building blocks)" (Langacker 1991a: 546). Behind semantic composition are complex construal operations that are ascribed to cognitive processes. Let us introduce one of the important theoretical devices in cognitive grammar that describes linguistic phenomena in terms of general cognitive processes.

Interpreting a given expression often requires a process to identify the entity that is not linguistically denoted but directly participates in the predication. Langacker notes: "a highly prominent substructure within the profile (i.e. the trajector or primary landmark) does not precisely coincide with the entity that participates most directly and crucially in the designated relation" (Langacker 1987: 271). Langacker introduces the notion "active zones" to capture such a construal operation by the conceptualizer who fills in a "discrepancy" between the profile and the entity (active zone) that is directly involved in the predication (see Langacker 1987: 271-274).

Active zones are defined as "[t]hose facets of an entity capable of interacting directly with a given domain or relation" (Langacker 1987: 272). Processes regarding identification of an active zone can be found not only in interpretation of the EAN construction, but also in other constructions. Consider the following examples (cited from Langacker 1987: 271).

- (8) a. We all heard the trumpet.
- b. Don't ever believe Gerald.
- c. I finally blinked.
- d. Bring me a red pencil.

For example, in (8a), it is the sound emitted by the trumpet and not a physical object of trumpet that impinges on our auditory apparatus and thus is called the active zone. In (8b), it is not the person called Gerald but the proposition itself (i.e., what Gerald says) that the process of believing pertains to and is the active zone. Likewise, in (8c), it is not the body as a whole but the eye or eyelid that is directly involved by blinking and is the active zone.

In (8d), an EAN phrase, which directly concerns with our discussions in this paper, the relations between the profile and active zones differ from those in (8a-c). In this case, either the outer surface of the pencil or the marks it creates when used for writing can be an active zone, because the trajector *pencil* is the writing implement whose active zone, in this case a color sensation, can be associated with either the outer surface or the marks it leaves on paper. A similar analysis can be found in Langacker (1991b), in which he writes: "The phrase *red pen* is ambiguous, and its ambiguity hinges precisely on the choice of active zone for pen with respect to the color predication. On the one hand, the active zone may be the color sensation associated with the outer surface of the pen ...; on the other hand, it may be the sensation associated with the marks left on the page when the pen is used as a writing implement" (Langacker 1991b: 192).

As well as Langacker, Sweetser follows a conceptualist approach and argues that a simple EAN construction such as *red apple* requires "a broad range of cognitive mechanisms (including metaphor, metonymy, frames, mental spaces, active zones and profiling, and implicit evocation of the speaker's epistemic and communicative spaces)" (Sweetser 1999: 129).

The conceptualist approach to the semantics of the EAN construction taken by Langacker and Sweetser is crucially different from that of the logical and generative analyses based on the objectivist view of semantics. In the objectivist view, it is argued that meaning of an expression can be gained by the manipulation of symbols. In this symbolic view, it is argued that "symbols get their meaning via a correspondence with the world, *objectively construed*, that is, independent of the understanding of any organism" (Lakoff 1987: xii). On the other hand, in the conceptualist approach, meaning is identified with conceptualization, which is "ultimately to be explicated in terms of cognitive processing" (Langacker 1991a: 4).

The preceding section introduced two practical problems that the objectivist approach suffers from. Let us discuss, in the remainder of this section, how the conceptualist approach solves these problems.

The first problem concerns the treatment of semantic ambiguity shown by instances like *green screens*. The conceptualist approach, unlike the objectivist approach, captures flexible conceptualization of instances such as *red pencils* as well as *green screens*, with the notions "active zones and profiles" as introduced above. The conceptualist approach thus seems to provide a solution to the first problem of the objectivist approach.

As the second problem with the objectivist approach, I pointed out that the objectivist approach does not account for any functional difference between the EAN and EPA constructions, and argued that such constructional properties need to be captured. Langacker

(1991b) introduces the notion "constructional schemas". Langacker writes: "A constructional schema represents a conventionally established pattern of bipolar integration. It is abstracted from some array of specific expressions and embodies the commonality observable in their formation; hence it captures any generalizations inherent in the data, can be used as a template for the assembly of novel expressions on the same pattern, and provides a basis for assessing their conventionality (well-formedness)" (Langacker 1991b: 298). Instead of appealing to various arbitrary symbolic rules in order to derive the EAN construction, using constructional schemas for linguistic analysis seems cognitively more realistic and theoretically preferable. By virtue of such advantages, one can describe the semantic relations of the components of this construction from the perspectives of the general cognitive processes of categorization and schematization. In order to avoid the second problem of the objectivist approach, this paper uses the notion constructional schemas as an important theoretical device.

3. Basic schemas of the Healthy-Noun construction

The previous section introduced the cognitive linguistics analysis of instances such as *red pencils*. In the remainder of the paper, we will chiefly focus our attention to the semantics of the Healthy-N construction. The reason why this paper examines the Healthy-N construction is that this construction shows us various interesting phenomena, including metaphor, metonymy, frames, and constructional function, which basic EAN phrases such as *red pencils* analyzed by Langacker do not offer us. Let us begin with examples that elaborate basic constructional schemas of this construction.

3.1. Prototypical schema

Instances elaborating the prototypical schema of this construction are those as in (9) below. In this type, what is referred to by the expression is the state of the referent's being free from illness.

- (9) a. According to wholistic practitioners, a **healthy animal** does not have fleas because its immune system is in proper working order and fleas are not attracted to a **healthy animal**, they prey on the sick and weak. [www.shamanshop.com/PawCares/fleas.html] (found in the GOOGLE search engine)
- b. You could not think of her as sick, as old, as anything but young and vigorous and vivid, as full of energy as a **healthy baby** that kicks its dresses into rags and wears out the strength of its strapping nurse. [Conflict: 60]

The referents denoted by the head nouns in the examples of (9) are classified as ANIMAL and HUMAN, which are both subsumed under the category ORGANISM.

Biologically, ORGANISM not only includes creatures but also plants. As shown below, those classified as PLANT also occur in this construction.

- (10) a. Some, such as **froghoppers** ("cuckoo spit") and **flea beetles**, cause little more than cosmetic damage and will be tolerated by **healthy plants**. [BNC: A0G 2462]
- b. The **mystery virus**, it was thought, would spread into the **healthy tree**, causing that too to become diseased. [BNC: A1M 196]

Prototypical instances of this construction include not only those above, but also such as follows:

- (11) a. As you can see a **healthy heart** has to work half as much to get the same amount of oxygen to your body. [www.fathersworld.com/health/9804/] (found in the GOOGLE search engine)
- b. The increasing use of dental and oral care preparations, and especially their use in combination, proves that there is a mounting interest in having **healthy teeth** and correct oral hygiene. [www.gaba.com/teeth_care/healthy_teeth.html] (found in the GOOGLE search engine)

The examples in (11) refer to the health condition of the referents, although in this case unlike (9) and (10), each referent is classified as ORGAN that is a part of the body of a living thing.

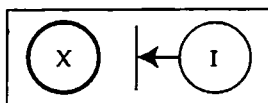
Referring to the health condition of a referent is not restricted to the physical property of an object. Depending on the object chosen, one can also refer to the mental state of the referent, as shown in the following examples.

- (12) a. If one of your friends lost this amount of weight from one Christmas to the next, changed from a fat person into a slim and **healthy person**, you would certainly notice! [BNC: AD0 1617]
- b. Positive symptoms refers to the behaviour a person with schizophrenia exhibit which is not normally present in a **healthy person**, such as: ... [www.lilly.ie/marketing/schizophrenia.htm] (found in the GOOGLE search engine)

Whether *healthy person* denotes either a physical or a mental property of the referent must be resolved in each context. For example, by virtue of the contextual effects, *healthy person* in (12a) refers to the health condition of the referent in terms of its physical property, whereas in (12b) it refers to the mental property of the referent.⁹

The semantics of such examples as above is to denote the state of a referent in question that is free from illness. The schema of this type can be depicted sketchily as follows.

<Figure 2>



In Figure 2, X enclosed in the left circle in heavy line denotes the referent denoted by the head noun (i.e., the object profiled in the construction). On the other hand, the letter I enclosed in the right circle is the abbreviation for illness. Note that this figure contains an imaginary obstacle between X and I that stops effects (denoted by an arrow) from I to X, by which it depicts that X is free from illness. The schema in Figure 2 is not meant to capture only the physical health of the referent. In fact, it is supposed to capture both the physical and mental health of a referent. It does not specify the effects of I (illness) to be either physical or mental illness. Based on the observations so far, we can characterize the semantic structure of the prototypical type of this construction as [X that is physically/mentally free from illness].

Since the referent denoted by the head noun of this type is a living thing, we can describe the prototypical schema of the Healthy-N construction as [HEALTHY LIVING THING]. Yet, I wish to emphasize urgently that characterizing the prototypical schema as such does not mean

⁹ An important question remains open. That is, when did *healthy* begin to be used to refer to a mental property in the history of English? This leads to a historical investigation of the conceptual development of *healthy*. In this paper, I will ignore this problem. Detailed studies on conceptual development will be provided in my future work.

to revive a semantic analysis similar to the one such as the classical selection(al) restriction analysis based on the classical theory of categorization introduced in section 2. Note, as already discussed in section 2, that such a feature-based approach is not empirically and psychologically plausible.

For example, given such an objectivist approach, one would analyze the semantics of the Healthy-N construction as follows. That is, the combination of *healthy* and a noun is guaranteed if the noun is classified as a living thing, [+LIVING THING], since the adjective has a feature [+LIVING THING]. However, such a classical symbolic approach cannot capture actual flexible conceptualization that plays a crucial role for interpretation and acceptability judgment of a given expression of this construction. Let us discuss the actual situation as to interpretation of this construction with some more examples where head noun referents seem to be classified as LIVING THING.

In the classical theory, one would predict such nouns classified as LIVING THING occur as a head in the Healthy-N construction. The fact is, however, more complicated. Note, for example, that while one can say *healthy dogs*, *healthy cats*, it is not natural to say *healthy cockroaches*, *healthy amoeba*. Furthermore, while it sounds natural to say *healthy nails*, *healthy hair*, as well as *healthy teeth* (11b), it is odd to say *healthy beard*, *healthy earlobe*, and *healthy bellybutton*, despite the fact that the referents denoted by the head nouns all belong to the body as ORGAN.

What underlies such acceptability judgments among these instances? One cannot capture this problem with the classical categorization theory. What is suggested here is that problems as to acceptability of the EAN construction go much deeper than the objectivist approach might expect. How should such facts be analyzed?

I argue that the preferable analysis of these examples is a frame-semantic analysis. Frames are "configurations of culture-based, conventionalized knowledge" (Taylor 1995: 89). Interpretation of words is not to be achieved independently of the flexible construal operations of the conceptualizer. Interpretation requires encyclopedic frame knowledge about the world and the flexible conceptualization processes.

I argue that interpretation and acceptability of those Healthy-N phrases as given above concern what might be called the HEALTH frame. The reason why *healthy nails*, *healthy hair*, and *healthy teeth* do not normally sound odd is that the HEALTH frame tells us that the health condition of the objects denoted by the head matters to us. Frames reflect the knowledge of the world. Since in the world (or society) where we live, the state of nails, hair, and teeth are considered to be informative, such nouns can occur in this construction. Conversely, since the HEALTH frame tells us that the state of the referent in *healthy beard*, *healthy earlobe*, and *healthy bellybutton* is not informative (since the health of the referent is not normally significant in our life), these phrases sound somewhat odd. Whether one sees X as informative or not depends on his/her conceptualization and the frames that one obtains in the environment where they live.

Taylor argues against the classical categorization model based on the feature theory that uses binary features and argues that "the grammaticality of word combinations is strictly a matter of either-or". Taylor instead suggests: "Acceptability is also a function of interpretability, given certain background knowledge. To the extent that an expression is interpretable, it will be accepted as well formed; otherwise will be rejected" (Taylor 1995: 92). The frame-semantic approach does not provide such either-or treatment as to acceptability. The underlying motivation of correlation between acceptability and interpretability is the flexible conceptualization based on the frame semantics of words.

The frame-semantic approach can also capture contextual effects on acceptability. For example, *healthy beard* is not as readily acceptable as *healthy hair*, but it would be acceptable if

given such a context as (13) below.

- (13) However, the process of growing a beard proved to be unexpectedly arduous and John looked around the stores for a shampoo product that would ease the discomfort and promote a healthy beard. [www.beardshampoo.com/Esooterica.html] (found in the GOOGLE search engine)

This suggests that the conceptualizer, thanks to the context, detects particular semantic aspects (e.g., sheen of it) in the referent of *beard*, and thus is able to interpret such an expression as informative to denote the health condition of such aspects of the object. Acceptability of an expression is highly susceptible to conceptualization, a context, or perhaps even to a speech community where one obtains his/her frames about the referent denoted by a word.

Given the above argument that acceptability of this construction depends on whether the health condition of the object denoted by the head noun is of interest or importance for the conceptualizer, it is easy to expect that objects such as internal organs to which human beings tend to pay attention in order to stay healthy should be likely to occur in this construction. In fact, it seems to be the case. For example, it is felicitous to say *healthy stomach*, *healthy lungs*, *healthy intestines*, *healthy kidneys*, *healthy brains*, and *healthy blood vessels*. People have the encyclopedic frame knowledge that keeping objects such as internal organs in a healthy state is crucial for one's health, and hence it is worth referring to the health condition of such objects. Therefore, it might be the case that in a society where one is not aware of the importance of internal organs as to the health condition of him/herself (e.g., due to the lack of contemporary knowledge of medical science or religious belief), equivalent expressions to the English Healthy-N phrases presented as above might not be acceptable.

Reflection of such flexible conceptualization processes as to acceptability of an expression is also found in other examples such as (9a). Given the above arguments, I argue that organisms that are categorizable as pets or those to be kept in a breeding ground are likely to elaborate this schema, since the health condition of such living things are of great interest for owners. In fact, observe that *healthy dogs*, *healthy cats*, *healthy horses*, and *healthy beetles* (in the context that they are kept by humans) all sound acceptable, while instances such as *healthy cockroaches*, *healthy fleas*, *healthy amoeba*, and *healthy parasite* do not sound felicitous. This is because the referents of the latter class are usually not categorizable as pets or living things that are kept by a human being.

Of course, like *healthy beetles* in the former class, the latter phrases could be acceptable depending on the person. For example, for biologists the latter phrases should be more readily interpretable. In fact, *healthy amoeba* sounds natural in a context as (14) below, where the health condition of the referent is considered informative.

- (14) A healthy *Amoeba* is quite active, extending pseudopodia in all directions and creeping along the slide. [http://www.science.smith.edu/departments/Biology/Bio111/Labmanual/01CELLS.htm] (found in the GOOGLE search engine)

Whether it is about a body part or the whole organism, the fundamental principle as to acceptability is the same: what matters to interpretation of a given expression is the frame-semantic knowledge of words that tells the conceptualizer if the expression is informative.

The observation as to interpretability and acceptability of the EAN construction as noted above would not be provided from the objectivist approach, since the classical theory does not account for the "informativeness" of a referent. Such an epistemic aspect of the conceptualizer is to be captured by the frame-semantic approach.

The findings here are also beyond the scope of the prototype theory, since the flexible mode of conceptualization does not conform to the natural hierarchical categories as suggested in this theory. Categorization involves what Barsalou (1983) calls "ad hoc" categories that are constructed by the conceptualizer to achieve certain goals. For example, if given a category out of context that consists of children, jewelry, portable television sets, photograph albums, manuscripts, and oil paintings, one would perhaps find it difficult to see conceptual coherence in these objects, but in the context "things to take out of one's home during a fire", it would become coherent (Medin and Wattenmaker 1987: 26). Existence of such "goal-derived categories" shows the limitation of the prototype theory. Whether or not one regards the health condition of an object as informative depends on the conceptualizer's subjective categorization, and this is highly context-dependent. As Medin and Wattenmaker suggest, "concepts are coherent to the extent that they fit people's background knowledge or naive theories of the world" (Medin and Wattenmaker 1987: 25).

As noted in section 2.1, the prototype theory claims that a category consists of members based on their similarity with the prototype in the category. However, as Medin and Wattenmaker (1987) argue, the prototype theory is also inadequate in this respect, because it uses the term "similarity" without giving any clear definition of the notion of similarity. This paper avoids the term similarity. What matters is perception of "relevance". Perception of relevance is the crucial motivation for categorization including extensions and schematization, and this is achieved based on the frame-semantic knowledge as argued in this section.

3.2. Metaphorical extension

The previous section discussed the prototypical schema of the Healthy-N construction that denotes the state of X's being free from illness. This construction also involves examples that are metaphorically motivated. This section briefly discusses metaphorical issues of this construction. Although much more detailed studies on the metaphorical phenomenon need to be developed, the objective in this section is simply to introduce some metaphorical schemas involved in this construction.

The following examples in (15) differ from those discussed in the preceding section in that they are metaphors, and interpretation of these involves a metaphorical mapping.

- (15) a. The ideal of beauty and normality cannot perish in a healthy society; and for this reason you ought to let art go its own way and be confident that it will not go astray ... [BNC: A18 1420]
- b. A healthy ecosystem is one that is diverse, sustainable, and balanced; an unhealthy one is one that lacks one or another of these characteristics. [BNC: B04 664]
- c. Healthy business, and integration of the Midland main line into the HST network, saw most of the fixed rakes expanded to eight vehicles. [BNC: A11 1550]

In (15), referents denoted by head nouns are not classifiable as LIVING THING in the biological sense, but are in the metaphorical sense. The example in (15a) involves the metaphorical mapping from the ILLNESS domain (source domain) to the SOCIAL domain (target domain). Likewise, (15b) involves the metaphorical mapping from the ILLNESS domain to the ECOLOGICAL domain. In (15c), the mapping from the ILLNESS domain is mapped onto the COMMERCIAL domain.¹⁰

Metaphors in the Healthy-N construction are not restricted to those types in (15). For example, one can find an example as in (16).

- (16) We can isolate it there, and we can save what's left in the tanks and we can run on the good cell. You close 'em, you can't open 'em again. You can't land on the moon with one healthy fuel cell. [APOLLO 13: transcript]

The example in (16) shows a metaphorical mapping from the ILLNESS domain to the MECHANICAL domain. It is the mechanical state of a thing (fuel cell) that is referred to with the word *healthy* (i.e., the thing that is free from mechanical troubles).

In the previous section, I characterized the prototypical schema as [HEALTHY LIVING THING]. The metaphorical schema discussed in this section can be characterized as [HEALTHY NONLIVING THING], under which such schemas as [HEALTHY SOCIAL SYSTEM], [HEALTHY ECOLOGICAL SYSTEM], [HEALTHY COMMERCIAL SYSTEM], and [HEALTHY MECHANICAL SYSTEM] are subsumed.

Of course, as well as the instances discussed in the previous section, it is not true that anything classified as NONLIVING THING can occur in this construction. Acceptability of metaphorical expressions also depends on whether or not the conceptualizer regards the health condition of the referent as informative. For example, it is felicitous to say *healthy planet* to denote the earth we live on, but it is infelicitous to talk about the health condition of other remote planets such as *healthy Neptune*, *healthy Uranus*, or even a closer one such as *healthy moon*, unless provided a particular context that activates one's interest in health condition of the referent. Here, the metaphorical mapping to the ECOLOGICAL domain as in (15b) is involved, but the acceptability depends on whether one is interested in the health condition of the referent.

The semantic structure of the superordinate schema [HEALTHY NONLIVING THING] of this metaphorical type is [X which is functioning well being free from troubles]. This superordinate schema involves several sub-schemas. The semantic structure of [HEALTHY SOCIAL SYSTEM] is [X that is free from bad social factors]. The semantic structure of [HEALTHY ECOLOGICAL SYSTEM] is [X that is ecologically balanced]. Likewise, the semantic structure of [HEALTHY COMMERCIAL SYSTEM] is [X that is commercially successful (growing)]. Finally, the semantic structure of [HEALTHY MECHANICAL SYSTEM] is [X that is free from mechanical troubles].

It is not true that objects categorized as NONLIVING THING always elaborate the metaphorical schema as introduced above. For example, one does not interpret a Healthy-N phrase whose head noun is *exercise* in the metaphorical way as discussed in this section. Expressions such as *healthy exercise* elaborate a result-oriented schema. The ability of choosing a different schema is driven by flexible conceptualization based on the frames of an object. Detailed discussions of will be provided in section 4.

4. More complex schemas of the Healthy-N construction

Section 3 discussed instances that elaborate the basic schemas. The Healthy-N construction involves schemas that do not conform to the schemas discussed so far. This section studies such examples.

4.1. Langacker's active-zone analysis

Earlier, I noted that in cognitive grammar it is possible to capture a different function between two constructions by the notion constructional schemas. In this section, I will mainly discuss

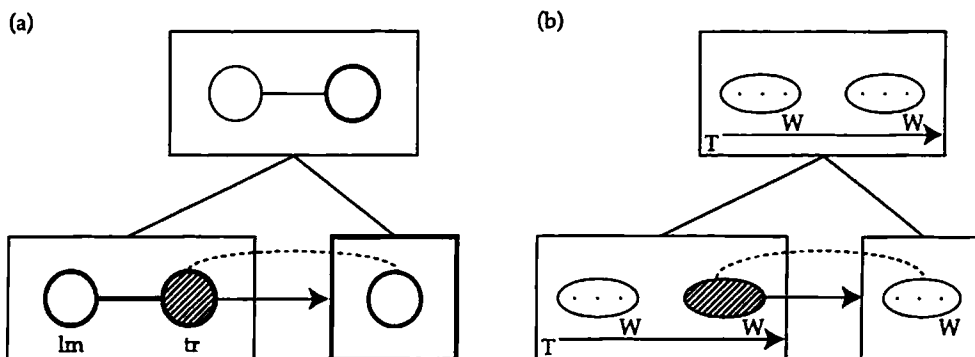
¹⁰ For the metaphor theory in cognitive semantics, see e.g. Lakoff and Johnson (1980), Lakoff (1990, 1993).

the semantics of the Healthy-N construction in terms of constructional schemas. Let us begin by introducing Langacker's treatment of the EAN construction from the perspective of the constructional schema.

As mentioned in 2.2, Langacker (1991b) introduces the notion constructional schemas that represent a conventionally established pattern of bipolar integration. For example, Langacker depicts a constructional schema of the EAN phrases in (17), as in Figures 3.¹¹

- (17) a. a yellow balloon
b. a clever boy
c. a large mansion

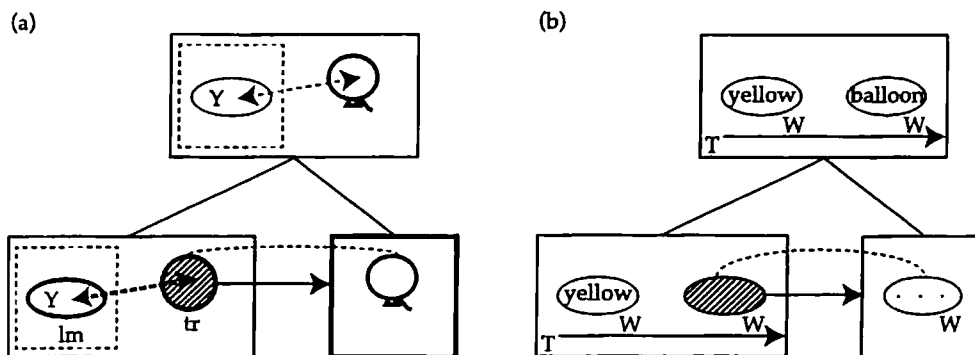
<Figure 3>



—Langacker (1991b: 298)

The constructional schema in Figure 3 reflects the commonality of the EAN phrases in (17). The internal organization of a constructional schema and that of the expressions from which the constructional schema is extracted are practically the same, apart from the difference in level of specificity. Figure 4 depicts the semantic and phonological poles of the composite structure of *yellow balloon* in (17a), which elaborates the constructional schemas in Figure 3.¹²

<Figure 4>



—Langacker (1991b: 294)

¹¹ Figure 3(a) indicates the semantic pole, and Figure 3(b) indicates the phonological pole. Note that this paper does not discuss the phonological pole.

Observe that, at the semantic pole of Figure 3 and 4, integration is caused "by a correspondence between the adjectival trajector and the nominal profile" (Langacker (1991b: 299). At the semantic pole of Figure 4(a), the landmark, labeled Y, is characterized as the yellow region of color space. The dashed arrow indicates the profiled relationship to characterize one of coincidence between the landmark region and a color sensation that is associated with the trajector. The dotted line indicates the correspondence of the trajector of [YELLOW] to the profile of [BALLOON], while the solid arrow indicates that [BALLOON] elaborates [YELLOW]'s schematic trajector. Conceptual fusion of the composite structure is obtained by superimposing the specifications of the elements.

As mentioned in 2.2, it is argued in cognitive grammar that a constructional schema "captures any generalizations inherent in the data, can be used as a template for the assembly of novel expressions on the same pattern, and provides a basis for assessing their conventionality (well-formedness)" (Langacker 1991b: 298). The commonalities among the instances such as *yellow balloon*, *clever boy*, and *large mansion* in (17) which elaborate the schema in Figure 3 are as follows:

- (18) a. The profile and the active zone both refer to the same object; the profiled object and the active zone cannot exist independently of each other.
- b. They occur both in the EAN construction and the EPA construction (see, for example, *a clever boy* vs. *The boy is clever*).

Examples elaborating the basic schemas discussed so far appear to conform to the "same pattern" as those elaborating the constructional schema of Figure 3 provided by Langacker, since they conform to the commonalities listed in (18). Note that, for example, *a healthy baby* refers to the health condition of a baby, and it is possible to say *the baby is healthy*.

I argue that the constructional schema of Figure 3 by Langacker is the prototypical schema of the EAN construction. Yet, the EAN construction involves, as will be argued in the following sections, instances that do not share the commonalities possessed by the instances in (18) or those discussed in section 3, and do not conform to the constructional schema in Figure 3. According to Langacker's characterization of constructional schemas, a different pattern among instances means the involvement of a different constructional schema. In order to attain a fine-grained description of the EAN construction, we need to provide a more sophisticated treatment of constructional schemas that this construction involves. The following sections will attempt to attain this goal.

4.2. Metonymic extension

Let us first see the examples in (19) below, which do not conform to the schemas of the Healthy-N construction as discussed so far. The examples in (19) elaborate the schema that is metonymically motivated.

- (19) a. He had a healthy look, with a weather-beaten face, his face corrugated, especially the large nose. [English traits: 927]
- b. He had a healthy colour in his cheeks, and his face, though lined, bore few traces of anxiety. [Two cities: 23]
- c. Does the world of good, gives them a healthy tan, makes them feel fantastic. [BNC: AM0 69]

¹² Here, I show both the semantic and phonological poles, but in this paper, as noted, we will not discuss the phonological pole.

The semantic structure of this schema is [X which indicates Y's being free from illness] (X=referent, Y=unprofiled participant). This is a metonymic extension from the prototypical schema introduced in 3.1 whose semantic structure is [X that is physically/mentally free from illness].

The relation between the adjective *healthy* and the referent denoted by the head noun in (19) differs from that in Figure 2. Observe that this schema involves one profiled participant and one "unprofiled" participant, while the prototypical schema involves only one profiled participant. Of course, as mentioned earlier, there is no exact matching of a profile to the active zone as we saw in examples such as (8d). The point here is, however, that the schema by Langacker cannot be used to capture the examples in (19) in a similar fashion, since they involve an unprofiled participant, unlike (8d) and the examples discussed in section 3. This is a crucial semantic difference between the two schemas. Such a difference needs to be captured.

Furthermore, the difference between the instances in (19) and the instances elaborating the prototypical schema can be found in its ability to occur in the EPA construction, as noted in (18b). Observe that the examples in (19) do not occur in the EPA construction, as shown in (20).

- (20) a. ?Her look is healthy.
- b. ?The colour is healthy.
- c. ?The tan is healthy.

Conversely, it is possible to put in the EPN construction such instances as *yellow balloon*, *clever boy*, and *large mansion* in (17), the examples used by Langacker to analyze the EAN construction.

- (21) a. The balloon is yellow.
- b. The boy is clever.
- c. His mansion is large.

Likewise, the examples in (9), (10), (11), and (12) introduced in 3.1 all occur in the EPA construction.

- (22) a. Those animals are healthy.
- b. The baby is healthy.
- c. These plants are healthy.
- d. The tree was healthy.
- e. Her heart is healthy.
- f. His teeth are healthy.
- g. That person is healthy.

As mentioned, this paper regards the functional difference between the EAN construction and the EPA construction as highly significant. In Langacker's active-zone analysis, the metonymic sense would be placed inside the predicate. That is, the metonymic sense of *healthy* in the examples in (19) is treated as a new predicate type whose trajector is the active zone of the "real" denotation of the predicate. If such an analysis by Langacker were correct, one would expect this predicate type to be available for the same predicate in different constructions, e.g., the EPA construction. However, this is not the case. As shown in (20), the metonymic sense of *healthy* in (19) is not available in the EPA construction, whereas the prototypical sense is. This implies that it is a property of the construction, not any element of the construction (William Croft, personal communication). The difference in acceptability depending on the construction as we saw above manifests relational difference between the adjective and the noun in question. If the two (adjective and noun in the EAN construction) have a different semantic relation, the

analyzer should not treat the examples in the same fashion as Langacker does for the examples in (17).

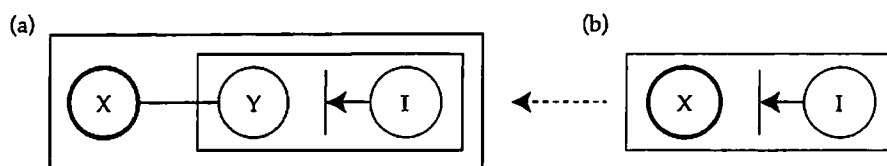
Then, what is the difference between the instances elaborating the prototypical schema and those in (19) elaborating the metonymically motivated schema? I argue that it is ascribed to the difference as to relational depth of adjective and noun. In other words, it is the degree of discrepancy between a reference point (profile) and an active zone that causes such a different behavior between the examples as shown in (20), (21) and (22). In the examples of (17), the discrepancy between the profile and its active zone seems "smaller" than that of (19). What do I mean by "smaller"? How do we measure it? Let us discuss this matter in more detail.

The depth of discrepancy derives from the relation between profile and active zone. In the former, since the object denoted by the profile and the actual active zone refers to the same object, the profiled object and the active zone cannot exist independently of each other. For example, whatever the active zone of *red pen* is, the profile and the active zone still refer to the same object (i.e., a pen). Conversely, in the latter, the profile is not the inherent property of the unprofiled participant (active zone). Note, for example, that one can get a tan or lose it, but remains the same person. In other words, the depth of discrepancy between a profile and an active zone is measured by the degree of inherence of the property to the object in question.

The different behavior as to acceptability in the EAN construction and the EPA construction derives from the depth of discrepancy. The fact that both the examples in (17) and those in (19) occur in the EAN construction, while the latter instances do not occur in the EPA construction suggests a functional difference between the two constructions that concerns the depth of discrepancy. In the EAN construction, one can interpret an expression with comparatively bigger discrepancy between the profile and the active zone, whereas it is not possible in the EPA construction. It appears that a smaller discrepancy is sanctioned in the EPA construction. The instances of (19) that are metonymically motivated are sanctioned by this function of the EAN construction. Such a functional difference between the EAN construction and the EPA construction is the crucial factor of acceptability of the expressions shown above.¹³

Figure 5(a) depicts the metonymic schema discussed in this section. Notice in Figure 5(a) that X is not the inherent property of the unprofiled participant (active zone). Y indicates the unprofiled participant whose health condition is evoked by the profiled participant X. Figure 5(b) is the prototypical schema. Figure 5 depicts that (a) is a metonymic extension from (b).

<Figure 5>



As the observations above show, the function of a construction and understanding of an expression is deeply correlated, and should not be treated separately. Understanding a given Healthy-N phrase is achieved through such cognitive processes as identification of a relevant active zone within the range of discrepancy that is constrained by the construction. Examples that are metonymically motivated as discussed in this section are hard to be captured with the classical objectivist approach, since understanding of such instances requires conceptualization

¹³ Questions such as how much discrepancy between a profile and an active zone that each construction sanctions are far beyond the scope of this paper, and I will save such inquiries for my future work.

that is based on the cognitive processes to read the relation of a profile and an active zone based on the frames of words in question.

The classical objectivist approach also does not offer a plausible analysis about the functional difference between the EAN construction and the EPA construction with respect to the discrepancy between profile and active zones as presented in this paper, since, as mentioned earlier, the logical and generative approaches ignore such a functional difference between the two constructions.

This section discussed examples that differ from the schemas analyzed in section 3 in terms of functional differences in the construction. There are some other examples that should not be analyzed by the active-zone analysis by Langacker (1991b). The next section studies such examples.

4.3. Involvement of event frames

This section discusses examples that elaborate constructional schemas related to causational events. Consider the examples below.

- (23) a. In addition to these advantages it possesses a perfectly healthy climate and a perennial supply of water which flows in abundance from the many springs round. [History of Rome: 42.54]
- b. Walking, cycling and swimming are healthy exercise which can help keep the patient's blood pressure down, if he does them sensibly, without putting himself under undue pressure. [BNC: AS0 479]
- c. Give her simple, healthy food. [Secret garden: 150]

The semantic structure of the examples in (23) is [X that is a source of Y's being/becoming free from illness] (X=referent, Y=unprofiled participant). This is different from the semantic structure of the prototypical schema and also the metonymically motivated schema as discussed in the preceding section.

As well as the examples in (19), the examples in (23) are metonymic expressions. Yet, we cannot treat the examples in (23) as we did those in (19), since interpretation of instances as in (23) requires frame knowledge about relevant causational events and the search for relevant active zones, unlike in (19) where the relation of the profiled reference point and the active zone in question is a part-whole relation, and does not involve an event frame.

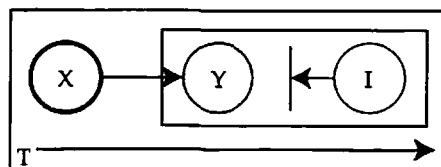
It might appear that the examples in (23) elaborate the metaphorical schema introduced in 3.2, since the head noun referents are categorized as NONLIVING THING. This is, however, not the case. They all elaborate the causational schema. For example, *healthy food* means "food that keeps one healthy" (i.e., food that is good for a person), not "food that is functioning well being free from troubles".

Figure 6 depicts the metonymic schema related to causational construal in the Healthy-N construction. In this figure, X indicates CAUSER and Y CAUSEE. Y is the unprofiled participant who is evoked by the HEALTH frame and whose good health is kept/caused by X.

The notion CAUSER is not monolith. For example, there is a subtle semantic difference between such instances as *healthy food* and *healthy exercise*. The former presupposes the food itself to be free from decay (thus, eating such food leads the eater to be in the state free from illness). In the latter, such a presupposition is not to be found. An exercise itself cannot be free from illness or any practical problems. Such a difference as to the notion CAUSER between the two instances is that the former denotes "retaining" causation while the latter denotes "result-oriented" causation. The causational effects on the causee are stronger in the latter. The

difference between the two is also dependent on the conceptualizer's subjective categorization. The construal operations on causation depend on folk physics or force dynamics (for the notion "force dynamics", see Talmy 1988).

<Figure 6>



I mentioned in 3.2 that there are instances in the Healthy-N construction that elaborate a different schema, even if the referent is categorized as NONLIVING THING such as *exercise*. As shown in (23b), *healthy exercise* elaborates the result-oriented schema, rather than state-oriented as in the instances in (15) and (16) do. What is the underlying mechanism of choosing a particular constructional schema? In the remainder of the section, I will discuss this problem focusing on instances in (23) that elaborate the metonymic schema.

I argue that selection of a constructional schema in the Healthy-N construction depends on whether one categorizes the referent as CAUSER or SUBSTANCE based on the frame semantics of words. Categorization of an object depends on the conceptualizer's subjective conceptualization. Each object has various semantic aspects that are given by the frame-semantic knowledge. For example, in the case of *exercise* (as in *healthy exercise*), its semantic aspects would include "good for one's health", "conducted by human beings", "takes body movement" and so on. Information processing is achieved by detecting a semantic aspect of the object that the conceptualizer regards as most relevant to meet his/her purposes for interpretation and/or communication with other speakers. In the examples of (23), the conceptualizer categorizes each object as CAUSER by detecting its causal aspect from various alternatives each object has. Detecting such a causal aspect leads to interpretation of the examples on a causation scale that says that X makes Y healthy. The reason why the examples discussed in section 3 elaborate a different schema is that the conceptualizer picks up an aspect "substance", not "causer", from the various potential semantic aspects the referents contain.

Interpretation of the Healthy-N construction requires the help of the knowledge about the HEALTH frame. One interprets the instances of (23) by searching the HEALTH frame and detecting a causal aspect of the object that s/he regards as most informative and relevant. Understanding expressions involves search of the frames about relevant events for a relevant aspect. This is not limited to the Healthy-N construction. For example, *sad story* means "a story that makes one feel sad", not "a story that is (feels) sad". Here again, as well as in (23), a similar categorization process operates. The conceptualizer takes *story* as a causer based on the knowledge about the SADNESS frame, which tells that a story can cause one to feel sad. This leads one to activate the relevant causal schema.

Elaboration of a constructional schema concerns the semantic aspect that the conceptualizer detects from a given object. Detection of a particular semantic aspect shows certain tendency, which reflects the frame-semantic knowledge of the conceptualizer about the object. In the case of *healthy food*, the reason that it normally elaborates the causal schema is that the conceptualizer picks up a particular semantic aspect of *food* that is not a substance, but a causer that keeps or makes one free from illness. It elaborates the schema, since, as opposed to such instances as *society*, *ecosystem*, or *fuel cell* as introduced in 3.2, for the conceptualizer such an

aspect of a causer is more important and directly informative when s/he perceives food than an aspect as a substance.

Such tendency as to categorization of an object is also reflected in acceptability. Some instances such as *healthy chair* or *healthy bicycle* are more easily understood than those such as *healthy photos* or *healthy toilet*, for the former are more readily associated with the HEALTH frame which tells us that these items are used in order to make/keep people healthy. Whether the conceptualizer takes an object as SUBSTANCE (something that is in the state of being healthy) or as CAUSER (something that is a causer to make causee healthy) is determined subjectively.

There are instances that elaborate either the prototypical schema or the causational schema, although the referent is categorized by the traditional categorization theory as LIVING THING. See the examples in (24), where *healthy bacteria* is construed either as a substance or a causer, according to the context it occurs in.

- (24) a. The bacteria are exposed to the toxic sample, and the amount of light they emit is measured by a photometer. Healthy bacteria will emit a greater amount of light, so the amount of light measured indicates the health of the bacteria, and thus the toxicity of the sample. [<http://www.geocities.com/sciencelives/microtox.html>] (found in the GOOGLE search engine)
- b. Antibiotics kill our healthy bacteria as well as the unhealthy bacteria and the yeasts are resistant to antibiotics. [www.holistichelp.net/newsletter9.html] (found in the GOOGLE search engine)

Such examples as *healthy bacteria* clearly show the involvement of the construal operations based on the frame-semantic knowledge about *bacteria* and its effect on elaborating a relevant constructional schema. *Healthy bacteria* can elaborate either the prototypical schema or the causational schema, since the frame about the word *bacteria* allows the conceptualizer to categorize it either as a substance or a causer.

The findings here cannot be properly captured with the objectivist approach based on the traditional theory of categorization. The symbolic semantic view does not capture flexible conceptualization. The facts discussed in this section can be captured with the frame-semantic approach, since it suggests that the conceptualizer detects a relevant aspect of an object based on his/her frame-semantic knowledge about the world.

5. Notes on the function of constructions

In 4.2, I mentioned that the EAN construction sanctions a bigger discrepancy between the profile and the active zone than the EPA construction. The difference of discrepancy concerns metonymic understanding of expressions. Metonymic expressions seem to be more readily sanctioned by the function of the EAN construction, but not by the EPA construction. This section discusses in more detail the functional difference between the two constructions.

Consider the following examples that show that the examples in (23) elaborating the causational schema do not occur in the EPA construction.

- (25) a. *The climate is healthy.
- b. *This exercise is healthy.
- c. This food is healthy.

The fact that acceptability of (25c) is higher than (25a-b) is ascribed to the difference that *healthy food* presupposes the food to be free from decay, whereas *healthy exercise* and *healthy climate* do

not (recall the argument about the two sub-classes of CAUSER in 4.3).¹⁴

What is the implication of (25)? I argue that it supports the arguments that the EPA construction sanctions a narrower range of discrepancy than the EAN construction. In the former construction, the metonymic sense is less permissible than the latter construction. The EAN construction sanctions a wider range of discrepancy between the profile and the active zone than the EPA construction. The prototypical sense of an adjective occurs both in the EAN and EPA constructions, while the extended sense tends to occur in the EAN construction.

Not only metonymic expressions but also metaphorical expressions as given in (15) and (16) appear to be unlikely to occur in the EPA construction, as shown below:

- (26) a. ?This society is healthy.
- b. ?The ecosystem is healthy.
- c. ?This business is healthy.
- d. ?Those fuel cells are healthy.

Of course, as is well known in the metaphor theory in cognitive linguistics, it is not the case that the EPA construction never sanctions any metaphors. See the examples in (27).

- (27) a. Your claims are *indefensible*. (Lakoff and Johnson 1980: 4)
- b. The argument is *shaky*. (Lakoff and Johnson 1980: 46)

As Clausner and Croft (1997) argue, metaphors vary in their degree of semantic schematicity. That is, "[d]omain relations function as generalizations over specific metaphorical expressions" (Clausner and Croft 1997: 247). That the expressions in (26) are infelicitous stems from the schematicity of the metaphorical schemas of the Healthy-N construction. Metaphors with small conceptual gaps between the source domain and the target domain can be interpreted as in (27). Conversely, in (26) the conceptual gap between the two domains is too big for one to understand them metaphorically. Here, we will not discuss the schematicity of metaphorical expressions of this construction any further. Yet, the facts presented in (26) and (27) suggest that the arguments in this paper are plausible, since acceptability of metaphors, as well as metonymic expressions, depends on the degree of inherence of the property. The prototypical sense of *healthy* occurs both in the EAN and EPA constructions, while metaphorical and metonymic expressions are more restricted. I ascribe this to the constructional properties.

Croft's (2001) Radical Construction Grammar (RCG) uses only taxonomic relations to characterize any type of grammatical generalizations. Conversely, in reductionist construction grammar (e.g., Kay and Fillmore 1999), it is argued that an element can be part of more than one construction. For example, in a reductionist construction grammar, it is argued that the part of the Intransitive Construction labeled VERB can also be a part of the Transitive Construction.¹⁵ The crucial characteristic of the RCG approach to grammatical generalizations is that its description is based on categorization. Unlike reductionist construction grammar and other formal syntactic theories such as generative grammar, RCG takes the categories of the construction characterized by the construction itself.

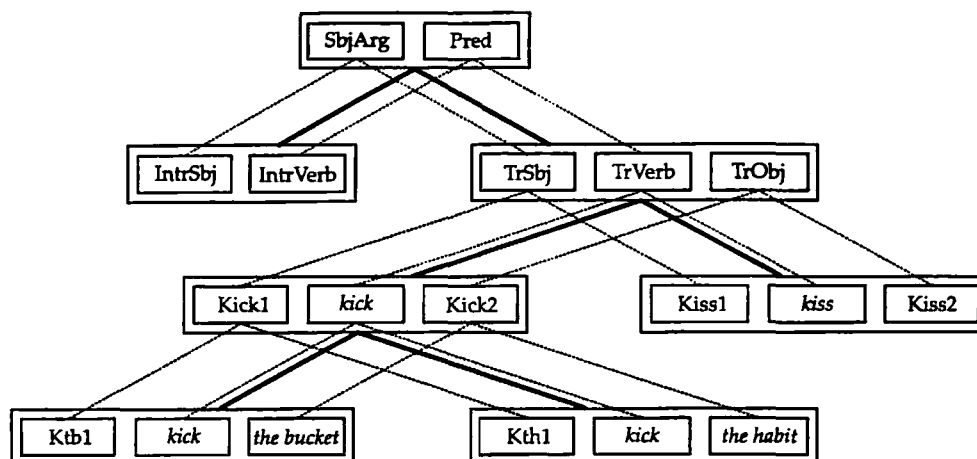
For example, Croft (2001) depicts the taxonomic hierarchy of argument structure constructions as in Figure 7. The broken lines link the construction parts and the heavy lines link

¹⁴ That (25c) is acceptable does not mean that *healthy food* elaborates the prototypical schema. As argued in 4.3, it elaborates the causal schema, by virtue of the semantic aspect the conceptualizer detects.

¹⁵ For more detailed discussions regarding the difference between RCG and reductionist construction grammar models, see Croft (2001: chapter 1).

the constructions as a whole.

<Figure 7>



—Croft (2001: 56)

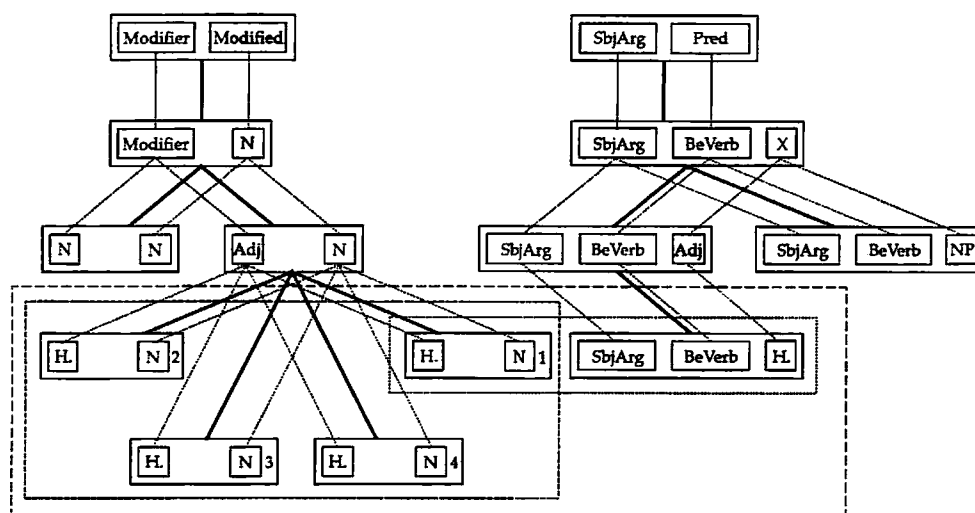
The taxonomic hierarchy in Figure 7 shows how RCG represents categories. In this figure, it describes constructions of English that represent the encoding of arguments of predicates. RCG claims that the categories of the construction are characterized by the construction itself. Note that each construction part in this figure is given its own category label. Each construction has its own schema, varying from others in generality and specificity. As Croft notes, the actual existence of the construction schemas is an "empirical question", and "can only be answered by the principles discovered by the usage-based model" (Croft 2001: 57). RCG takes categorization seriously, and seeks linguistic descriptions that are empirically and psychologically realistic. The claims of RCG are indeed well supported by various pieces of empirical evidence, ranging from typological studies to child language acquisition and historical development of language.¹⁶

This paper follows the RCG approach to characterize the category of the Healthy-N construction. Following the convention of Croft's RCG, I depict the taxonomic hierarchy of the EAN construction and the EPA construction, as in Figure 8. Figure 8 depicts how the different senses of *healthy* are motivated by the construction. This figure provides the Modifier Modified construction as a superordinate construction, in which the English Modifier-Noun (EMN) construction is included. Figure 8 also shows that the EMN construction involves the English Noun-Noun (ENN) construction (e.g., *stone house*) and the EAN construction that are both in the taxonomic relation with it.¹⁷ The figure also provides a taxonomic hierarchy of argument structure constructions, in which the EPA construction is included. The functional difference between the EAN construction and the EPA construction derives from the constructional category to which they belong.

¹⁶ For its validity and the methodological background of Radical Construction Grammar, see the discussion by Croft (2001: 1.6)

¹⁷ Shibuya (2000) argued that the EMN construction also involves various other constructions such as the English Adjectival Past Participle-Noun construction (e.g., *broken pencils*). See Shibuya (in preparation) for more detailed analyses of the EMN construction.

<Figure 8>



H.: *healthy*, 1: prototypical schema (physical/mental health), 2: metaphorical schema (function of the referent), 3: metonymic schema ("part-whole"), 4: metonymic schema ("causational")

In Figure 8, the box in dotted line indicates that the two schemas of the EAN and EPA constructions share the similar sense of *healthy*. The box in broken line indicates that *healthy* in the EAN construction includes the prototypical sense and some nonprototypical senses (in this case, metonymic and metaphorical senses) that are not shared by the EPA construction. The box shown by long broken lines indicates the overall semantic category of *healthy*, i.e., the overall distribution of *healthy* in these two constructions. In this figure, we only limit attention to limited senses of *healthy*, so it is important to note that the figure does not attempt to cover extensive cases of the semantics of this adjective.

As mentioned in 4.2, Langacker's active-zone analysis of the EAN construction would treat the metonymic sense of *healthy* as a new predicate type whose trajector is the active zone of the real denotation of the predicate. One cannot, however, use such an analysis for metonymic senses, because the active-zone analysis does not account for the infelicity of such a metonymic sense in the EPA construction. As well as metaphors, the origin of the metonymic senses should be ascribed to the functional properties of constructions. The adjective *healthy* in the examples elaborating the causational schema does not get a metonymic reading "to make the referent of the noun healthy" on its own. It gets such a sense from the EAN construction. Likewise, the examples in (19) elaborating the "part-whole" schema get the metonymic senses from the construction.

Why does the EAN construction sanction metonymic senses that are not available in the EPA construction? I argue that the fact that the EAN construction allows a wider range of discrepancy between the profile and the active zone than EPA construction reflects communicative economy of the EAN construction for being such a small construction consisting of a modifier and a head noun. Compared to the EPA construction that can be added more components, the EAN construction is a "closed" construction, whose meaning denoted by the limited number of components should be identified with the help of flexible conceptualization processes based on the frame knowledge. The EAN construction urges one to seek the frames evoked by the head noun for a relevant active zone in a more extensive way than the EPA

construction. What matters is the function of the construction, through which one attempts to resolve discrepancy between a profile and an active zone using the frame knowledge of words in question.

The constructional approach to semantic compositionality as discussed in this section is preferable than the objectivist approach that misses the functional difference between the two constructions. In 2.1, I mentioned the case of *happy student* and *happy suggestion*. One can say *the student is happy* but cannot say *the suggestion is happy*. Given the discussion above, we are now able to analyze the semantics of such examples as follows. That is, the conceptualizer interprets the metonymic sense of *happy* in *happy suggestion* by searching the HAPPINESS frame for an unprofiled participant (Y) who becomes happy by the suggestion. It is the EAN construction that urges the conceptualizer to search the frame in an extensive way for a relevant active zone. Succeeding in identifying an appropriate active zone leads to the activation of the relevant causational schema.

6. Conclusion

This paper discussed the semantics of the Healthy-N construction. The objectivist approach presupposes symbolic view of meaning that suggests that interpretation of expressions is conducted independently of conceptualization. I argue, based on the arguments as presented in this paper, that such a symbolic approach cannot capture semantic compositionality of the EAN construction in an empirically plausible way, since interpretation of this construction involves flexible construal operations of the conceptualizer as we observed.

Construal operations of an expression show a probabilistic pattern. It is not the case that all speakers interpret a given EAN construction in the same way (recall examples such as *healthy bacteria*). Conceptualization is a central aspect of semantics, and such an aspect can be captured with the frame-semantic approach.

As well as the frame-semantic approach, one of the main features of this paper was to provide a constructional approach to semantic compositionality. By capturing a functional difference between the EAN construction and the EPA construction as to the range of discrepancy between a profile and an active zone that is sanctioned by the construction itself, I have shown that the constructional approach provides a more fined-grained description of the EAN construction than the objectivist approach and Langacker's (1991b) active-zone analysis.

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